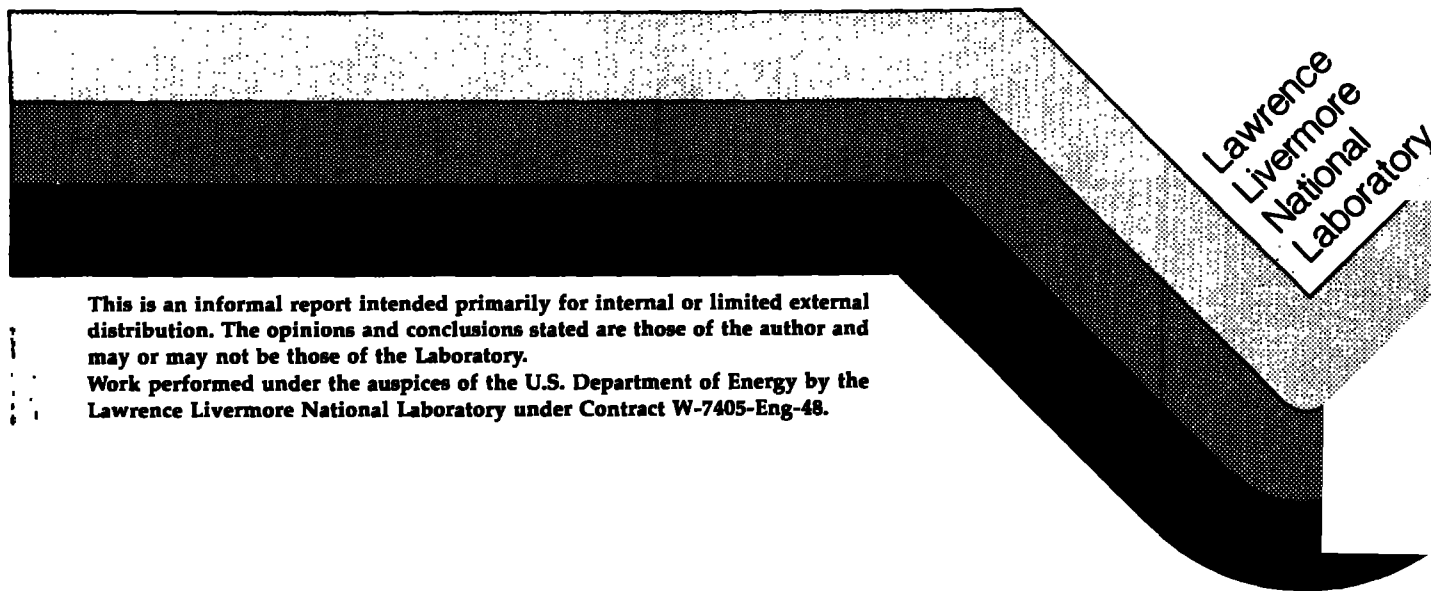


PROGRAM PLAN FOR EMP SURVIVABILITY  
OF NAVY C2 SYSTEMS

V. R. Latorre, LLNL  
R. A. Greenwell, SEA, Inc.

**CIRCULATION C**  
**SUBJECT TO REC**  
**IN TWO WEEK.**

August 1986



This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the Laboratory.

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

## DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

Printed in the United States of America  
Available from  
National Technical Information Service  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, VA 22161  
Price: Printed Copy \$ ; Microfiche \$4.50

<u>Page Range</u>	<u>Domestic Price</u>	<u>Page Range</u>	<u>Domestic Price</u>
001-025	\$ 7.00	326-350	\$ 26.50
026-050	8.50	351-375	28.00
051-075	10.00	376-400	29.50
076-100	11.50	401-426	31.00
101-125	13.00	427-450	32.50
126-150	14.50	451-475	34.00
151-175	16.00	476-500	35.50
176-200	17.50	501-525	37.00
201-225	19.00	526-550	38.50
226-250	20.50	551-575	40.00
251-275	22.00	576-600	41.50
276-300	23.50	601-up <sup>1</sup>	
301-325	25.00		

<sup>1</sup>Add 1.50 for each additional 25 page increment, or portion thereof from 601 pages up.

## SUMMARY

This report provides a plan for implementing the Navy Tactical C2 EMP Survivability Program. This program will emphasize the development of EMP standards and specifications for all phases of a C2 system's life from its concept formulation phase through its total in service life. In order to achieve an EMP survivable Navy C2 system, the U. S. Navy must develop a program that will provide appropriate guidance and direction.

## ADMINISTRATIVE INFORMATION

This work was performed for the Naval Ocean Systems Center, Code 825, EMC Engineering Branch by Lawrence Livermore National Labs., Code L156, under Work Request #N6600185WR00394. This report covers the period from 1 May 1985 to 31 March 1986.

## **Executive Summary**

### **Objective**

This report provides an update to a plan for implementing the Navy Tactical C2 EMP Survivability Program. The program emphasizes the development of EMP standards and specifications for all phases of a C2 system's life from its concept formulation phase through its total in-service life. To achieve EMP survivable Navy C2 systems, the Navy's program provides appropriate guidance and direction.

### **Approach**

The thrust of the program is directed to the specific needs of the Navy's EMP shipboard test and evaluation effort. Documentation and test planning for the C2 survivability of the first shipboard platform to undergo extensive threat level EMP testing is the program's immediate concern. Lessons learned from ship tests will be extended to the operational life of the ship as well as to other Navy platforms and shore facilities.

### **Progress**

In fiscal year 1985, the program produced a shipboard EMP environmental standard and updated the program plan to incorporate the concepts and philosophies of PMS-423 and OP-941F. Other deliverables included:

- . EMP library file,
- . Review and analysis of Navy C2 prioritization studies,
- . Preliminary review and analysis of EMP and related EME standards and specifications,
- . Review of non-Navy EMP programs, standards, and specifications.

## TABLE OF CONTENTS

1.0	OBJECTIVES.....	1
2.0	APPROACH.....	2
3.0	BACKGROUND.....	4
4.0	PROGRAM MANAGEMENT.....	4
5.0	PLANS, MILESTONES, AND DELIVERABLES.....	5
6.0	PROGRESS - 1985 TO DATE.....	5
7.0	PUBLICATIONS.....	5

## TABLES

TABLE 5.1	Plan of Action and Milestones for EMP Survivability of Navy C2.....	6
TABLE 5.2	<u>WORK BREAKDOWN</u> Structure for EMP Survivability of Navy C2.....	11



## PROGRAM PLAN:

### EMP SURVIVABILITY OF NAVY C2

#### 1.0 Objectives

The survivability of United States Navy assets to electromagnetic pulse (EMP) is required by OPNAV Instruction 3401.3. In particular, the command and control (C2) functions are singled out by this OPNAVINST as requiring special interest.

The primary method of hardening against EMP is platform shielding. This is also the least costly approach. However, there are areas of a ship that will not be protected by platform shielding, for example, the bridge, helicopter bay, and bulkheads. Under wartime conditions these accesses can be reduced or curtailed, but even then other EMP protection procedures must be utilized to assure that the platform will be protected.

The objective of this program emphasizes standards and specifications for EMP survivability of critical C2 systems on surface platforms. This program is a subset of the overall ship EMP hardening program. The development of specifications and standards will consider all phases of a system's life from its initial conceptual formulation through its total in-service use. In between and within all phases of system's life, standards and specifications set the framework for each phase. Major phases include:

- a. Concept formulation;
- b. Design validation;
- c. Full-Scale development;
- d. Production; and
- e. Operation and support.

The initial concept and design phases should include all EMP hardening and cost estimate guidelines. The development and manufacturing phases require EMP production controls that can be validated and contractually enforced. Finally, the installation, operation, and support phases must cover the total in-service life of the system and include system updates, conversions, and service life extensions. During all phases of the system's life, test methods and procedures will be developed to insure valid products, installation techniques, and proper operation.

This program will not only provide Navy EMP standards and specifications, but it will also direct a fleet hardening implementation effort. Standards and specifications provide an ordered approach to each level of EMP hardening. A vulnerability assessment and test and evaluation effort will verify the validity of these documents as well as develop qualified hardening technologies for fleet use.

Experience gained during the initial phase of the program can then be translated with appropriate constraints into standards and specifications for critical C2 shore support systems. Eventually, they will extend to critical C2 systems on aerospace platforms and subsurface platforms. Many

of these efforts can occur simultaneously depending on funding and time requirements.

## 2.0 Approach

In order to accomplish the objectives stated above, the thrust of this program is to initially direct all of its efforts, documentation development, and test planning to the specific needs of the Navy's shipboard EMP hardening. This means that the C2 survivability of the first shipboard platform to undergo extensive threat level EMP testing is this program's immediate concern. Initial efforts are being focused to support the CG-47 class ship program. The documentation will later become more oriented to all shipboard platforms.

To support this approach, the C2 EMP Survivability Program will follow two major time lines, both of which are integrally related. The C2 standards and specifications development effort will provide the necessary documents (i.e. specifications, test methods and procedures, and standards) to support the shipboard testbed test and evaluation effort. Concurrently, the EMP shipboard hardening program will provide the necessary inputs (i.e., test plans, vulnerability data analysis, systems data analysis, and test results) to improve, and/or modify the standards and specifications documentation for general Navy shipboard use. Results from this program will provide the following deliverables:

- . Navy C2 EMP Standards, Specifications, and Handbooks;
- . Qualified C2 technologies for fleet use;
- . and other products for Fleet hardening implementation.

Table 2.1 presents a graphical representation of the interaction of the various elements of the C2 EMP Survivability Program and its role in the overall ship EMP hardening Program.

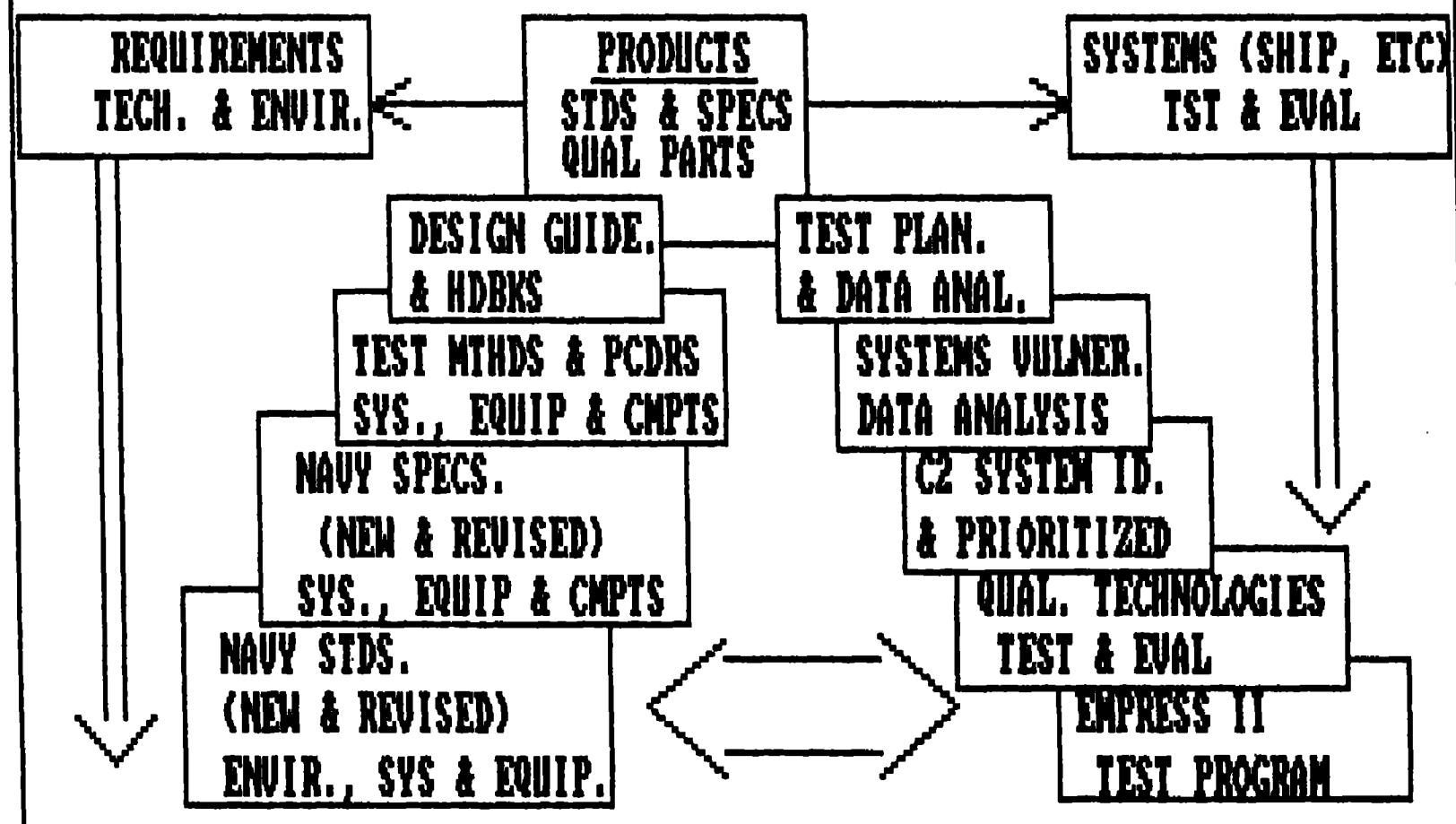
The thrust of this approach is to establish and develop critical C2 systems' EMP standards, specifications, and handbooks through the utilization of existing and newly available test data. Existing data will include relevant EMI/EMC test data as well as all available EMP test data. From these established vulnerability baselines the next step is to apply them (as required) to existing standards and specifications in order to revise, supplement, modify, or add new standards and specifications to address EMP survivability of critical C2 systems. They will be verified through a testbed EMP test and evaluation program. This effort will be accomplished by means of:

- a. Referencing existing standards and specifications where applicable to the EMP survivability of critical C2 systems;
- b. Incorporating known options and EMP hardening procedures into existing standards and specifications; and
- c. Establishing new design methodologies and hardening options which are not currently under consideration, and append these cost-effective survivable concepts to existing standards and specifications as well as incorporate these hardening options into fleet C2 systems.



# C2 EMP SURVIVABILITY PROGRAM

## SHIP EMP HARDENING (NEW & REFIT)



d. Finally, the lessons learned from ship EMP hardening will be extended to the operational life of ship as well as be extended to other Navy platforms and shore facilities.

### 3.0 Background

In September 1982, the Naval Ocean Systems Center consolidated past data and published a Navy tactical C2 EMP survivability plan for then PM-23 which emphasized the need for Navy EMP standards and specifications. This document, NOSC TD 547, was based on guidelines provided by PM-23 and OPNAV 941FC. Since then, several DOD/Navy instructions and committees have amplified the need for publication of Navy EMP standards and specifications.

Recognizing the need to establish Navy standards and specifications to address the procurement and enhancement of EMP-protected systems, the Under Secretary of Defense for Research and Engineering (USDRE) requested in December 1981, that the Defense Nuclear Agency (DNA) develop a DOD EMP Standardization and Specification Program. Following reviews and modifications of the DNA suggested program, the DOD EMP Standardization Program was officially established in December 1982 and began in 1983. The Deputy Secretary of Defense designated the Assistant to the Secretary of Defense for Atomic Energy ATSD(AE) as the DOD focal point for this program. Under the ATSD(AE) charter, the Navy will be responsible for seabased platforms; the Air Force will concentrate on aircraft platforms; the Army will address mobile ground systems; and the Defense Nuclear Agency will have cognizance over fixed ground facilities.

Several other government instructions and directives were issued which emphasized the acquisition of nuclear survivable systems. The first DOD instruction, DODI 4245.4, provided the basic direction for procurement of nuclear hardened systems. The Navy published their own instruction, OPNAVINST 3401.3, which specifically addresses nuclear survivability of Navy and Marine Corps systems, and stresses the need for established standards and specifications. A few requirements' documents now exist throughout the Defense Department and the most recently published standard, DOD STD 2169, addresses the EMP environment. No document specifically addresses the Navy's C2 shipboard systems. Based on these requirements and utilizing available documents, NOSC is assisting PMS-423 and OP-941F in translating the DOD needs and criteria into standards and specifications for Navy surface platforms.

### 4.0 Program Management

The organizational structure for the Navy Tactical C2 EMP Survivability Program provides for overall direction and relationships with major service/agency EMP activities. Major activities comprising this organizational structure in order of direction and level of involvement are as follows:

- CNO, Electromagnetic Spectrum Management Branch, OP-941F, Sponsor and funding activity.

- NAVSEA, Theater Nuclear Warfare Project Office, PMS-423 - Program Manager and principal Navy coordinator for nuclear survivable programs.

- NOSC, Project management and technical activity tasked by PMS-423.

It is anticipated that NOSC will interface and coordinate with other services/agencies to insure proper technical direction. These technical coordinations will include representation on the DOD TAG Shipboard Hardening Committee, and the DNA HAMS Coordinating Committee.

Control over task assignments, labor expenditures, costs, scheduling, and performance will be exercised by NOSC, which will employ proper management techniques to achieve the efficient integration of the interdependent efforts of the various project team members to include:

- schedules, milestones, and deliverables;
- manpower loading;
- program funding projections and cost estimates;
- quarterly reviews.

## 5.0 Plans, Milestones, and Deliverables

Table 5.1 lists the tasks, deliverables, start and stop dates, and funding for the C2 EMP Survivabilities program, Table 5.2 provides a work breakdown structure time lines for each task.

## 6.0 Progress - 1985 to date

In fiscal year 1985, the primary objective of this program was to establish a shipboard EMP environmental standard and update the old program plan (NOSC TD 547) to incorporate the concepts and philosophies of PMS-423 and OP-941F. A MIL-STD XYZ was developed and delivered in Sept 1985, and will initially be published as a NAVSEA technical report. Once established, this generic environmental standard will provide input and direction for Navy test methods and procedures, handbooks, and design guidelines for EMP hardening of Navy tactical C2 systems. Besides the environmental standard and the program plan, other deliverables were provided to include an EMP library file; a review and analysis of Navy C2 prioritization studies; a preliminary review and analysis of EMP and related EME standards and specifications; and a review of non-Navy EMP programs, standards and specifications.

## 7.0 Publications

a. NOSC TR 807, Navy Tactical C2 Node Prioritization for EMP Survivability in the 1990's (U), 15 June 1982, San Diego, CA 92152-5000 [Conf].

b. NOSC TD 547, Navy Tactical C2 EMP Survivability Program Plan (U), 30 Sept 1982, San Diego, CA 92152-5000.

c. NOSC TR 904, External Communications System Deactivation Analysis Aboard USS Belknap (CG 26) (U), Sept 1983, San Diego, CA 92152-5000.

d. MIL-STD XYZ (USN), Electromagnetic Pulse (EMP) Environment Criteria for US Navy Shipboard Systems (U), 15 Oct 1985, San Diego, CA 92152-5000 [Sec].

**TABLE 5.1 Work Breakdown Structure for EMP Survivability of Navy C2**

	<b>TASK ITEM DESCRIPTION</b>	<b>DELIVERABLE</b>	<b>PLANNED START</b>	<b>SCHEDULE STOP</b>	<b>FUNDING (\$K)</b>
1.0	Navy standards and specifications development	Various Docs.	5/85	9/91	(2550)
1.1	Develop/establish Navy standards (new and revised)	Navy Stds.	5/85	9/91	(750)
1.1.1	Establish environmental standard for specific Navy surface platform environment	Navy Stds.	5/85	10/86	75
1.1.2	Develop C2 systems standard for critical C2 surface platform systems	Navy Stds.	8/86	9/87	225
1.1.3	Revise MIL-STD 1310 to include C2 systems bonding, grounding and other techniques	Std. Mod.	9/86	9/88	50
1.1.4	Revise MIL-STD 1395 to include selection of EMP hard, critical C2 networks	Std. Mod.	9/86	9/88	75
1.1.5	Revise/update and review MIL-STD 461C to include surface platform emission and susceptibility requirements for EMP hard, critical C2 Systems	Std. Mod.	9/87	9/90	75
1.1.6	Update and Review C2 systems standards	Std. Mod.	10/87	9/91	250
1.2	Develop/establish Navy specifications (new and revised)	Navy Specs.	4/86	9/92	(550)
1.2.1	Revise MIL-E 16400 to incorporate C2 systems EMP requirements for surface platforms. (Various revisions already in progress for EMP modifications)	Spec. Mod.	5/85	9/89	75
1.2.2	Revise MIL-E 6051 to incorporate 6.2 systems specs for surface platforms in an EMP environment	Spec. Mod.	6/86	9/90	125

**TABLE 5.1 Work Breakdown Structure for EMP Survivability of Navy C2**

	<b>TASK ITEM DESCRIPTION</b>	<b>DELIVERABLE</b>	<b>PLANNED START</b>	<b>SCHEDULE STOP</b>	<b>FUNDING (\$K)</b>
1.2.3	Develop/establish TPD spec (purpose draft and modify for new TPD's)	Navy Spec.	6/86	6/88	350
1.2.3.1	Evaluate LINK 11 TPD	Test Rept.	12/86	6/88	150
1.2.3.2	Develop new TPD spec	Navy Spec.	10/86	6/88	200
1.2.4	Develop new specs for new EMP technologies	Navy Specs.	as needed	9/92	unk
1.3	Develop/establish Navy test methods and procedures to evaluate C2 systems on surface platforms	Various Docs.	6/86	9/92	(675)
1.3.1	Develop test methods and procedures for TPD evaluation	Tech. Rept.	6/86	7/87	100
1.3.2	Develop/establish test methods and procedures for shipboard hardening of C2 systems on a surface platform (i.e. CG-47 class)	Tech. Rept.	6/86	6/88	200
1.3.3	Develop test methods and procedures for large aperture and compartments in surface ships	Tech. Rept.	6/86	9/87	150
1.3.4	Revise/update MIL-STD 462 for measurement of EMP tests on C2 systems	Navy Std.	10/86	9/88	75
1.3.5	Revise/update MIL-STD 1605 to incorporate procedures for conducting a shipboard EMP on C2 systems	Navy Std.	10/87	9/89	75
1.3.6	Revise/Update and Review MIL-STD 1377 to incorporate C2 system cable connector shielding measurements	Navy Std.	10/88	9/90	75

**TABLE 5.1 Work Breakdown Structure for EMP Survivability of Navy C2**

	<b>TASK ITEM DESCRIPTION</b>	<b>DELIVERABLE</b>	<b>PLANNED START</b>	<b>SCHEDULE STOP</b>	<b>FUNDING (\$K)</b>
1.3.7	Develop new test methods and procedures for new EMP technologies	Tech. Repts.	as needed	9/92	unk
1.4	Develop/establish Navy handbooks and guidelines to design EMP hardened C2 systems on surface platforms	Various Docs.	10/86	9/91	(575)
1.4.1	Develop C2 EMP handbook	Tech. Rept.	10/86	9/87	75
1.4.2	Review/revise and update MIL-STD 463 to include the appropriate C2 EMP definitions	Navy Std.	4/87	9/88	75
1.4.3	Review/revise and update MIL-HDBK 237 to incorporate C2 EMP management techniques for surface platforms, C2 systems, and C2 equipment	Navy Handbook	6/87	9/89	125
1.4.4	Review, revise and update MIL-HDBK 253 to provide the guidance for the design and test of C2 systems protected against EMP	Navy Handbook	5/88	9/89	75
1.4.5	Review, revise & update MIL-HDBK 235 to include EMP environment considerations for design and procurement of C2 equipment	Navy Handbook	10/88	9/89	75
1.4.6	Review, revise and update MIL-HDBK 241 to provide design guidance for EMP production in C2 system power	Navy Handbook	6/89	9/90	75
1.4.7	Review, revise and update MIL-STD-1857 to incorporate design practices of grounding bonding, and shielding into C2 EMP hard surface ship systems.	Navy Std.	3/90	9/91	75
2.0	Shipboard EMP Hardening test and evaluation	Various Docs.	5/86	9/92	(3475)

TABLE 5.1 Work Breakdown Structure for EMP Survivability of Navy C2

	TASK ITEM DESCRIPTION	DELIVERABLE	PLANNED START	SCHEDULE STOP	FUNDING (\$K)
2.1	Develop EMP vulnerability baselines for surface platform (i.e. CG-47) C2 systems based on ambient, EMC, EMP, and nuclear	Tech. Repts., Test Plan & Test Rept.	5/86	9/88	(875)
2.1.1	Identify critical C2 systems for a surface platform (i.e. CG-47)	Tech. Rept.	5/86	9/86	50
2.1.2	Collect, analyze and evaluate exiting platform test data, component test data, and operating systems test data	Tech. Rept.	5/86	3/87	155
2.1.3	Perform cable coupled EMP scale model tests on CG-47 and FFG-15	Test Rept. Test Plan	5/86	3/87	105
2.1.4	Perform large aperture and compartment EMP scale model EMP scale model tests on CG-47	Test Rept. Test Plan	5/86	6/87	165
2.1.5	Perform scale model EMP tests on selected C2 systems	Test Rept.	1/87	9/88	400
2.2	Develop design hardening guidelines through EMP vulnerability assessment for surface platform critical C2 systems in all four life cycle phases (design, test & evaluation, production & installation, and operation & maintenance)	Various Repts.	2/86	9/89	(1,000)
2.2.1	Review and evaluate all relevant existing standards and specifications for applicabilities to EMP hardening	Tech. Rept.	2/86	8/86	80
2.2.2	Identify existing options/fixes for EMP hardening critical C2 systems on CG-47 class ships	Tech. Rept.	2/86	3/88	520

TABLE 5.1 Work Breakdown Structure for EMP Survivability of Navy C2

TASK ITEM DESCRIPTION	DELIVERABLE	PLANNED START	SCHEDULE STOP	FUNDING (\$K)
2.2.3 Develop design methodologies for EMP hardening critical C2 ship systems	Tech. Rept.	10/86	9/89	400
2.3 C2 EMPRESS Test Plan	Test Plan	10/86	6/90	(400)
2.3.1 Participate in TAG meetings in preparation for EMPRESS tests		as required		unk
2.3.2 Coordinate efforts between NOSC & NSWC		as required		unk
2.3.3 Prepare C2 EMP Test Plan	Test Plan	10/86	3/89	200
2.3.4 Perform pretest assessment on FFG and CG	Tech. Rept.	10/86	6/90	100
2.3.5 Integrate and review overall test plan & make changes	Test Plan	6/86	6/90	100
2.4 Collect/analyze CG-47 test data and recommend changes to C2 systems	Test Rept.	5/90	8/91	400
2.5 Revise/update CG-47 C2 systems hardening	Tech. Rept.	6/91	1/92	400
3.0 Integrate lessons learned and extend to other Navy C2 Systems	Various Docs.	as required		unk
3.1 Integrate lessons learned and extend to the DDG-51 C2 systems	Various Docs.	as required		unk
3.2 Integrate lessons learned and extend to the shore support facilities	Various Docs.	as required		unk
3.3 Integrate lessons learned and extend to to aerospace/ submarine platforms	Various Docs.	as required		unk



EMP HARD PGM: C2 EMP SURVIVABILITY PGM

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	1.0 NAVY C2 EMP STANDARDS AND		△	△	△	△	△	△	△
02	SPECIFICATIONS DEVELOPMENT								
03									
04	2.0 SHIPBOARD EMP HARDENING			△	△	△	△	△	
05	TEST AND EVALUATION								
06									
07	3.0 INTEGRATE LESSONS LEARNED					AS REQUIRED			
08	AND EXTEND TO OTHER NAVY C2								
09	SYSTEMS								
10									
11									
12									
13									
14									
15									
16									
17									
18									

11

# EMP HARD PGM: 1.0 NAVY C2 EMP STDS & SPECS DEVELOPMENT STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	1.1 DEVELOP/ESTABLISH NAVY	—	△	△	△		△	△	
02	STANDARDS (NEW & REVISED)								
03									
04	1.2 DEVELOP/ESTABLISH NAVY		—	△	△	△	△	△	△
05	SPECIFICATIONS (NEW & REVISED)								
06									
07	1.3 DEVELOP/ESTABLISH NAVY		—	△	△	△	△	△	△
08	TEST METHODS & PROCEDURES								
09									
10	1.4 DEVELOP/ESTABLISH NAVY			—	△	△	△	△	△
11	HANDBOOKS AND GUIDELINES								
12									
13									
14									
15									
16									
17									
18									
19									

EMP HARD PGM: 2.0 SHIPBOARD EMP HARDENING  
TEST AND EVALUATION

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	2.1 DEVELOP EMP VULNERABILITY		△	△	△				
02	BASELINES FOR SURFACE PLATFORM								
03	C2 SYSTEMS								
04									
05	2.2 DEVELOP DESIGN HARD GUIDES		△	△	△				
06	FOR CG-47 CRITICAL C2 SYSTEMS								
07									
08	2.3 C2 EMPRESS TEST PLAN		△	△	△				
09									
10	2.4 COLLECT/ANALYZE CG-47 TEST					△	△		
11	DATA								
12									
13	2.5 REVISE/UPDATE CG-47 C2							△	△
14	SYSTEMS HARDENING								
15									
16									
17									
18									

EMP HARD PGM: 3.0 INTEGRATE LESSONS LEARNED TO  
OTHER NAVY C2 SYSTEMS

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	3.1 INTEGRATE LESSONS LEARNED						AS	REQUIRED	
02	AND EXTEND TO DDG-51 C2 SYSTEMS								
03									
04	3.2 INTEGRATE LESSONS LEARNED					AS	REQUIRED		
05	AND EXTEND TO SHORE SUPPORT								
06	FACILITIES								
07									
08	3.3 INTEGRATE LESSONS LEARNED					AS	REQUIRED		
09	AND EXTEND TO AEROSPACE/								
10	SUBMARINE PLATFORMS								
11									
12									
13									
14									
15									
16									
17									
18									
19									

EMP HARD PGM: 1.1 NAVY C2 EMP STANDARDS

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	1.1.1 ESTABLISH ENVIRONMENT	—	△	—	△				
02	STANDARD								
03									
04	1.1.2 DEVELOP C2 SYSTEMS			—	△				
05	STANDARD								
06									
07	1.1.3 REVISE MIL-STD-1310 TO			—	△				
08	INCLUDE C2 EMP								
09									
10	1.1.4 REVISE MIL-STD-1395 TO			—	△				
11	INCLUDE C2 EMP								
12									
13	1.1.5 REVISE/UPDATE & REVIEW			—	△				
14	MIL-STD-461C								
15									
16	1.1.6 UPDATE AND REVIEW C2			—	△				
17	SYSTEMS STANDARD								
18									

## EMP HARD PGM: 1.2 NAVY C2 EMP SPECIFICATIONS

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
01	1.2.1 REVISE MIL-E-16400 TO					△			
02	INCLUDE C2 EMP								
03									
04	1.2.2 REVISE MIL-E-6051 TO						△		
05	INCLUDE C2 SYSTEMS EMP								
06									
07	1.2.3 DEVELOP/ESTABLISH TPD SPEC		△		△				
08	1.2.3.1 EVALUATE LINK 11 TPD				△				
09	1.2.3.2 DEVELOP TPD SPEC				△				
10									
11	1.2.4 DEVELOP NEW SPECS FOR						AS NEEDED		
12	NEW TECHNOLOGIES								
13									
14									
15									
16									
17									
18									
19									

EMP HARD PGM: 1.3 NAVY C2 EMP TEST METHODS & PROCEDURES STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	1.3.1 DEVELOP TEST METHODS & PROCEDURES FOR		_____Δ						
02	TPD EVALUATION								
03									
04	1.3.2 DEVELOP/ESTABLISH TEST METHODS &		_____Δ						
05	PROCEDURES FOR SHIPBOARD EMP TEST								
06									
07	1.3.3 DEVELOP TEST METHODS & PROCEDURES FOR		_____Δ						
08	LARGE APERTURE/COMPARTMENT								
09									
10	1.3.4 REVISE/UPDATE MIL-STD-462 FOR C2 EMP TESTS			_____Δ					
11									
12	1.3.5 REVISE/UPDATE & REVIEW MIL-STD-1605				_____Δ				
13									
14	1.3.6 REVISE/UPDATE & REVIEW MIL-STD-1377					_____Δ			
15									
16	1.3.7 DEVELOP NEW TEST METHODS & PROCEDURES					_____Δ			
17	FOR NEW TECHNOLOGIES EVALUATION								Δ
18									

EMP HARD PGM: 1.4 NAVY C2 EMP HANDBOOKS & GUIDELINES

STATUS AS OF 7/1/86

81

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	1.4.1 DEVELOP C2 EMP HANDBOOK			—△					
02									
03	1.4.2 REVIEW/REVISE & UPDATE			—△					
04	MIL-STD-463								
05									
06	1.4.3 REVIEW/REVISE & UPDATE			—△					
07	MIL-HDBK-237								
08									
09	1.4.4 REVIEW/REVISE & UPDATE				—△				
10	MIL-HDBK-253								
11									
12	1.4.5 REVIEW/REVISE & UPDATE					—△			
13	MIL-HDBK-235								
14									
15	1.4.6 REVIEW/REVISE & UPDATE						—△		
16	MIL-HDBK-241								
17									
18	1.4.7 REVIEW/REVISE & UPDATE							—△	
19	MIL-STD-1857								



EMP HARD PGM: 2.1 EMP VULNERABILITIES BASELINES FOR  
SURFACE PLATFORM C2 SYSTEMS

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	2.1.1 IDENTIFY CRITICAL C2 SYSTEMS FOR CG-47		—△						
02	CLASS SHIPS								
03									
04	2.1.2 COLLECT/ANALYZE & EVALUATE EXISTING		—△						
05	PLATFORM TEST DATA, COMPONENT TEST DATA, AND								
06	OPERATING SYSTEMS TEST DATA								
07									
08	2.1.3 PERFORM CABLE-COUPLED EMP SCALE MODEL		—△						
09	TESTS ON CG-47 AND FFG-15								
10									
11	2.1.4 PERFORM LARGE APERTURE & COMPARTMENT		—△						
12	EMP SCALE MODEL TESTS ON CG-47								
13									
14	2.1.5 PERFORM SCALE MODEL EMP TESTS ON			—△					
15	SELECTED C2 SYSTEMS								
16									
17									
18									

EMP HARD PGM: 2.2 DESIGN HARDENING GUIDELINES FOR  
SURFACE PLATFORM CRITICAL C2 SYSTEMS

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	2.2.1 REVIEW/EVALUATE ALL		—△						
02	EXISTING STDS, SPECS, HDBKS, AND								
03	GUIDELINES FOR EMP HARDENING								
04	CG-47 CLASS SHIPS								
05									
06	2.2.2 IDENTIFY EXISTING HARDENING		—	—△					
07	OPTIONS/FIXES FOR EMP HARDENING								
08	CRITICAL C2 SYSTEMS ON CG-47								
09	CLASS SHIPS								
10									
11	2.2.3 DEVELOP DESIGN			—△					
12	METHODOLOGIES FOR EMP HARDENING								
13	CRITICAL C2 SHIP SYSTEMS								
14									
15									
16									
17									
18									
19									

EMP HARD PGM: 2.3 C2 EMP EMPRESS TEST PLAN

STATUS AS OF 7/1/86

MILESTONES		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92
		1234	1234	1234	1234	1234	1234	1234	1234
01	2.3.1 NOSC PARTICIPATION IN TAG	_____	_____	_____	AS REQUIRED				
02	MEETINGS IN PREPARATION FOR								
03	EMPRESS TESTS								
04									
05	2.3.2 NOSC COORDINATION WITH		_____	AS REQUIRED		_____			
06	NSWC ON MASTER PLAN								
07									
08	2.3.3 PREPARE C2 EMP TEST PLAN			_____	_____	△			
09									
10	2.3.4 PERFORM PRETEST ASSESSMENT			_____	△	_____	△		
11									
12	2.3.5 INTEGRATE & REVIEW				_____	_____	△		
13	OVERALL TEST PLAN & MAKE								
14	CHANGES								
15									
16									
17									
18									

